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AN UPDATE ON THE USE OF THE CANMET TELEMETRY SYSTEM AT THE SYNCRUDE MINE

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AN UPDATE ON THE USE OF THE CANMET TELEMETRY SYSTEM AT THE SYNCRUDE MINE

by

N.J. Stuart*

ABSTRACT

This report summarizes a cooperative field project being undertaken by Syncrude and the Surface Mining Laboratory at the Syncrude oilsands mine near Fort McMurray, Alberta. The report includes descriptions of the project history, current status and work planned for the future.

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UTILISATION DU SYSTÈME DE TÉLÉMÉTRIE DU CANMET À LA MINE SYNCRUDE: MISE À JOUR

par

N.J. Stuart*

RÉSUMÉ

Le présent rapport décrit brièvement un projet d'étude sur le terrain entrepris par la Syncrude et réalisé en collaboration avec le Laboratoire d'exploitation minière en surface, à la mine de sables bitumineux de la Syncrude près de Fort McMurray en Alberta. Ce rapport contient de plus, une description de l'historique du projet, du statut actuel des travaux et des études projetées pour l'avenir.

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1. INTRODUCTION

In August 1985 the CANMET radio telemetry monitoring system was installed at the Syncrude oilsands mine at Fort McMurray, Alberta. This system was originally designed for use at the WESTAR hydraulic mine at Sparwood B.C. to monitor surface mounted tiltmeters.

The initial installation at Syncrude in August 1985 consisted of a series of tiltmeters located close to the dragline to monitor working bench slope stability. In August 1986 a follow-up visit to the mine site was undertaken to review and address problems encountered with the August 1985 installation and to interface the system slave stations to inclinometer sensors. An inclinometer is a traversing sensor located in a specially cased borehole that measures lateral displacement along the axis of the borehole.

2. REVIEW OF THE SYSTEM

2.1 PROBLEMS ENCOUNTERED DURING THE WINTER 85-86:

On arrival at the Syncrude site a brief memo was circulated by Mr. Terry Stevens of Syncrude which included a list of problems encountered:

1. "Slave Stations were not operational in temperatures below -20°C and therefore will require environmentally protective covers to maintain the internal temperature above this lower limit."

This is the major hardware problem encountered. The system was found to run down to temperatures below -25°C at Sparwood. However, since then 'improved' radio modules have been installed. A remedial measure has been installed. This consists of a toggle switch which when switched on will cause current to flow through resistors in proximity to the

critical components of the transmitter and receiver units. This greatly reduces the expected battery life. If, as is hoped and expected, this greatly increases the ambient operating temperature range then more precise and efficient measures may be taken. An example of one such measure is the use of temperature controlled crystals in the R.F. oscillators. These components are commercially available and would eliminate frequency drift with temperature for very little extra power consumption.

It is certain that acceptable operating temperature ranges can be achieved but at present there is an element of 'cat and mouse' in determining the temperature dependent components. It is hoped that the contractors (Ecological and Resources Consulting Ltd. - ECRL) will be able to make a second visit in December and that the weather will be obligingly cold.

2. "When the system is required to autostart, normally due to power interruptions, the program automatically reverts to recording its programmed date which is 01-01-80. For reference purposes the system must log the actual start up date, and not the programmed one."

This is an annoying feature of the system but hardly a major shortcoming. It can be rectified by installing a clock/calendar card into the IBM PC. ERCL staff will advise on a suitable card.

3. "When the system's program is changed, it will read on the programmed interval once before reverting to a continuous monitoring mode. This continuous mode will remain in effect until 23.59 hours, at which time it will return to monitoring at it's originally programmed interval. Once the system has started the continuous monitoring mode, the computer must be shut off in order to reprogram the scanning interval."

This is a serious software bug. It is understandable that such bugs should come to light but it is not acceptable that the program should be locked so that software maintenance cannot be carried out on site. ERCL personnel accept, it is believed, that the present situation is at variance with standard engineering practice and will rectify both the bug and the locked nature of the program disk as soon as possible.

4. "Operating problems are often indicated by screen error messages such as 5-565, 5-580, 5-590. These messages are only indicated on the screen and are not printed out, thus being lost if the system resumed monitoring."

   "Instruction manuals were not included with the system, therefore any problems which occurred were difficult to solve, if solved at all."

These two comments reflect a real problem with documentation. Such documentation that does exist is very good. It describes the principles of the system but little or no information is available on system errors and trouble shooting. This is another area where it is believed that an oral agreement was reached with ERCL to correct the problem. The failure of the error messages to uniformly transfer from the screen to the printer is another minor software bug.

5. "The system test message fell to 2.38, which was below the recommended 2.40 - 2.60 range. No reason was identified for this drop."

The system test message is one of many voltage checks in the system. This 'problem' occurred when the more important 'VB3' battery check was indicating 'no problem'. The system test message is a measure of the supply voltage across the microprocessor. Since digital electronics function over a wide range of voltages and cannot 'drift' as the analogue components do, the originally specified range of 2.4 - 2.6 is far too stringent. No real problem was occurring.

6. "Tilt readings fluctuated with temperature readings."

"Tilt readings fluctuated during repetative scans, possibly due to wind effect, which would indicate the tiltmeter system to be too sensitive for this environment."

This sort of misbehaviour is always difficult to demonstrate on demand. It is, however, thought that:

i) Temperature should not have a major effect on readings.

ii) Vibrations and wind might be detectable by the system but this is not a fault of the system of measurement.

iii) There is a general failure to understand the effect of the eight bit precision in the analogue to digital conversion. An eight bit converter will convert an analogue (voltage) input as one of 2^8=256 possible values (0-255). Thus a temperature sensor channel set to read temperatures between e.g. -40 and +40C (80 degree range) would have a resolution of 80/256 i.e about 0.3 degrees. The computer might make the conversion with an equation similar to:

$$T = -40 + \frac{R \times 80}{255}$$

(where T is the calculated temperature and R the reading). Since the computer will generally calculate this value to many (meaningless) decimal places one would generally round off this figure to one decimal place for display on the screen.

If, as is often the case, the temperature is close to the boundary between two digital values, random fluctuation may cause the reading displayed on the computer to fluctuate by 0.3 degrees on closely spaced readings (as the analogue to digital converters 'least significant bit' is 'flipped'). These precision related errors occur on all the channels

read and it is necessary to be aware of them, to understand that they reflect the theoretical accuracy of the system and are not grounds for concern. Further, these calculated values are used for further calculations such as temperature and voltage corrected tilt readings. Such derived results use many channels of input each with conversion error and thus have a level of 'drift' that has no physical significance.

7. "Slave batteries required a minimal recharging schedule for this program."

This suggests that there is spare power available for heating the R.F. components.

2.2 WORK CARRIED OUT DURING THE FIELD TRIP:

Two slaves underwent hardware modification. R.F. relays were installed to enable both reception and transmission to occur through the directional antenna, interfaces were installed so that they could support the borehole type 'slope indicator' probes and temporary heating resistors were installed with toggle switches.

A modified slave was tested in a trial hole and the results compared with previously measured values. A good agreement was obtained. Two meetings were held with the Syncrude staff, the first to discuss the document described above and the latter to discuss the future of the system.

2.3 THE CURRENT POSITION:

When the system was installed at Syncrude in 1985, tiltmeter sensor sites were installed at both the dragline working bench (highwall) and the tailings areas. Neither proved to be useable during the year. In particular the highwall system, which was the less experimental set up,

did not have the reliability to warrant the effort required (new tiltmeter mounts and the movement of the slave station as the dragline moves along the working bench and the care of batteries). Thus the first year can hardly be counted a success.

3. PLANNED RESEARCH

3.1 Work at Hand:

Despite the problems of the last year it would seem apparent that we are close to having a system that could make a real contribution to the highwall monitoring project. During times of high concern about highwall stability, slope indicator surveys are run at frequent intervals on the bench close to the dragline. Often this requires that the dragline be stopped for 10 minutes during the survey; each 10 minutes of lost dragline time results in thousands of dollars in lost production. The lost time is because one cannot safely operate a dragline while people are working beneath the boom. If, subsequent to such a slope indicator survey, the CANMET system monitored the borehole probe (left at the most active horizon) then that horizon could be sampled at a high frequency (perhaps every five minutes). This could give both a more continuous and accurate picture of the development of instabilities and give confidence to reduce the frequency of complete borehole slope indicator surveys (and therefore dragline downtime). It is simply a matter of addressing the problems described at the start of this report to create such a functional system; that is to say solving the temperature problem, software maintenance and documentation. It would seem reasonable to assume that these can be solved during the coming winter.

3.2 Future and related work:

The ideal system from the point of view of the Syncrude geotechnical group would be one that could do entire borehole surveys remotely. ERCL believe that they could build such a system. It would be mounted in a

small trailer and require modifications to the existing communication protocol. This might entirely eliminate dragline downtime due to borehole surveys and enable a high borehole survey rate. This type of system was envisaged when the idea of an enhanced telemetry system was considered. The size available would mean that power and temperature considerations would not present a problem as the trailer could include a generator or power feed, for battery charging. ERCL presented the idea to Syncrude, who seemed potentially interested at an initial development cost of around $100,000. This would be an attractive project as the slope indicator survey system is widely used in mining and other geotechnical applications and it may be assumed that there would be wide applications for a fully automated remote reading system.

The discussions suggested that the case for an upgraded telemetry system is strong. The present system cannot sensibly address the needs of the tailings area where a large number of channels are required per slave. There are other potential applications including the control of the flow in the tailings pipe.

3.3 The Timing of Events:

It is hoped that the problems with the software and documentation can be solved by a December meeting. At that time the temperature may well be low enough to also determine the temperature sensitive components. Further temperature related modifications fall into two categories: replacement of components and thermostatic control. Simple thermostatic control based on temperature in the slave cabinet would be easy to implement, however control based on the temperature around the R.F. components would probably need to be thermister driven and would require development. On the temperature question it is likely that a December visit will aid in the diagnosis of the problem but a solution of the problem will likely take a few more months.

4. CONCLUSION:

The project has suffered from problems which though minor from a technical point of view were major from a practical point of view. Those problems have served to highlight the need for frequent communications and site visits during such field demonstration projects. All being well, the system should be in a state where it can reliably be used for down hole monitoring of static inclinometers by April 1987.

Syncrude is a major user of inclinometers. The instrument manufacturer has developed a computer based data collection system with radio and hardwire data transmission capability. With encouragement, that manufacturer may well consider the development of automatic inclinometer hole traversing equipment combined with their existing computer based data transmission/collection system.